CALIBRATION STANDARD REQUIREMENT

FOR A

300 MHz GENERAL PURPOSE OSCILLOSCOPE

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PROCUREMENT PACKAGE

Prepared by: Naval Warfare Assessment Division
Measurement Science Directorate
Code MS-33
Corona, CA 91718-5000

September 1995
Encl (1)

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1. SCOPE

1.1 Scope. This requirement defines the mechanical, electrical, and electronic characteristics for a 300 MHz bandwidth, two channel, Gener Purpose Oscilloscope. This equipment is intended to be used by Navy person in shipboard and shorebased laboratories to measure time-varying signals. the purpose of this requirement, the 300 MHz General Purpose Oscillosco shall be referred to as the Scope.

2. APPLICABLE DOCUMENTS

2.1 Controlling Specifications. MIL-T-28800, "Military requirement, Test Equipment for use with Electrical and Electronic Equipment, Genera specification for," and all documents referenced therein of the issues effect on the date of this solicitation shall form a part of this requireme

3. REQUIREMENTS

3.1 General. The Scope shall conform to the Type II, Class 5, Style E requirements as specified in MIL-T-28800 for Navy shipboard and shorebased as modified below. The use of material restricted for Navy use shall governed by MIL-T-28800.

3.1.1 Design and Construction. The Scope design and construction shall meet the requirements of MIL-T-28800 for Type II equipment.

3.1.2 Power requirements. The Scope shall operate from a source of 103.5V to 126.5V 60Hz (5% single-phase input power as specified in MIL-T-28800.

3.1.2.1 Fuses or Circuit Breakers. Fuses or circuit breakers shall be provided. If circuit breakers are used, both sides of the power source sha be automatically disconnected from the equipment in the event of excessi current. If fuses are used, only the line side of the input power line, defined by MIL-T-28777, shall be fused. Fuses or circuit breakers shall readily accessible.

3.1.2.2 Power Connection. The requirements for power source connections shall be in accordance with MIL-T2-28800.

3.1.3 Dimension and Weight. Maximum dimensions shall not exceed 15 inches (31 cm) in width, 9 inches (23 cm) in height, and 19 inches (48 cm) in dep The weight shall not exceed 30 pounds (14 kg).

3.1.4 Lithium Batteries. Per MIL-T-28800, lithium batteries are prohibited without prior authorization. A request for approval for the use of lithi batteries, including those encapsulated in integrated circuits, shall submitted to the procuring activity at the time of submission of proposal Approval shall apply only to the specific model proposed.

3.2 Environmental Requirements. The Scope shall meet the environmental requirements for a Type II, Class 5, Style E equipment with the deviatio specified below.

3.2.1 Temperature and Humidity. The Scope shall meet the conditions below:

	Temperature((C)	Relative Humidity(%)
Operating	10 to 30	95
	30 to 40	75
Non-operating	-40 to 70	Not controlled

3.2.2 Electromagnetic Compatibility. The electromagnetic compatibility requirements of MIL-T-28800 are limited to the following areas: CE01, CE CS01, CS02, CS06, RE01, RE02 (14 kHz to 1 GHz), and RS03.

3.3 Reliability. Type II reliability requirements are as specified in MIL-T-28800.

3.3.1 Calibration Interval. The Scope shall have an 85% or greater probability of remaining within tolerances of all requirements at the end o 12 month period.

3.4 Maintainability. The Scope shall meet the Type II maintainability requirements as specified in MIL-T-28800 except the lowest discrete compone shall be defined as a replaceable assembly. Certification time shall not exceed 60 minutes.

3.5 Performance Requirements. The Scope shall provide the following capability as specified below. Unless otherwise indicated, all requirement shall be met following a 30-minute warm-up period

3.5.1 Display. The Scope shall have a display with a graticule of at least by 10 divisions. The divisions shall be further subdivided into five minor divisions by markings along the main axis.

3.5.1.1 Set-up Display. The display shall show, along the top, bottom, or both, the time/division, volts/division for each active channel, probe identification, trigger level, and Delta-V or Delta-T between the cursors, applicable.

3.5.1.2 Display controls. There shall be separate controls to adjust the trace intensity, readout intensity, graticule illumination, and focus.

3.5.2 Vertical Input Channels. The Scope shall have at least two (2) vertical input channels. For the purpose of this requirement, they a referred to as channels 1 and 2.

3.5.2.1 Channel Selection. It shall be possible to display the channels simultaneously, either by alternating sweeps, or by chopping at a frequency at least 1 MHz. It shall also be possible to invert channel 2, and to repl the display of channels 1 and 2 with their sum or difference.

3.5.2.2 Deflection Factor. Deflection (amplitude) shall be selectable from 2 mV/division to 5 V/division in a 1-2-5 sequence, with uncertainty of (2% setting with a signal of at least four divisions. The Scope deflection sh be continuously variable from 1(to 2.5(the selected deflection setting. uncertainty specification does not apply when the variable control is not the 1(position.

3.5.2.3 Frequency Response. The Scope shall have a bandwidth, defined by the upper 3 dB point, of at least 300 MHz, with a low pass 20 MHz filte selectable. The Scope step response rise time shall not exceed 1 ns.

3.5.2.4 Coupling. Each channel shall be separately selectable between DC coupling, AC coupling (lower 3 dB point no higher than 10 Hz), and ground.

3.5.2.5 Input Characteristics. Input impedance shall be 1 Megohm + .5%, in parallel with 15 pF (2 pF. Maximum input voltage (DC + peak AC) shall be Volts. This mode is allowed for any coupling.

3.5.2.6 Vertical Position. The Scope shall have a separate control for each channel to vary the vertical position of each trace by at least four divisi from the center graticule.

3.5.3 Horizontal Subsystem. The Scope shall have two time bases. For the purposes of this requirement, they shall be referred to as A and B. The Sc shall have the following display modes: Time base A only, Time base B on alternate between A and B, Time base A with an intensified portion expanded Time base B (delayed sweep). The Scope shall also have an XY mode which u one channel to provide the X-axis and another channel for the Y axis.

3.5.3.1 Sweep Rate. Time base A shall have a sweep range of 5 ns/division to 500 ms/division; Time base B shall have 5 ns/division to 50 ms/divisio There shall be a 10(magnification control extending the fastest effecti sweep rate to at least 1 ns/division.

3.5.3.2 Variable Control. The Scope shall have a continuously variable control with range of at least 3:1. the control shall multiply the A ti base if the sweep is in A mode, and the B time base in all other modes.

3.5.3.3 Timing Uncertainty. The Scope's timing shall be accurate to the following requirements.

A Sweep: ((1.2% of measurement + .06 divisions).
B Sweep: ((1.5% of measurement + .09 divisions).

Using a 200 ms/division or 500 ms/division sweep rate may increase th uncertainty by (.5% of the measured interval. The uncertainties may also increased by (.5% if the 10(magnification is being used.

3.5.3.3.1 Delayed Sweep Uncertainty. Delay uncertainty is from start of A sweep to trigger of B sweep. This is in addition to uncertainties in A an sweeps.

Delay uncertainty: ((.5% of delay + 0.06 divisions) - (0 - 25 ns).

3.5.3.4 Delay Range. The delay from A sweep to B sweep shall be continuously variable from 0 to at least 9.95 times the seconds/divisi setting of the A sweep, provided the A sweep is no faster than 10 ns/divisi The delay jitter shall not exceed ((.005% of maximum delay + 50 ps).

3.5.3.5 Horizontal Position. The Scope shall have a continuously variable control to adjust the beginning of the trace to anywhere within (5 divisio of the left most graticule line.

3.5.4 Triggering. The Scope shall allow the sweep to be triggered from any channel.

3.5.4.1 Coupling. The Scope shall have a control to select between the following forms of coupling: DC coupling, AC coupling (reject below 60 Hz LF (below 80 kHz) reject coupling, or HF (above 30 kHz) reject coupling. A coupling shall be allowed with any source.

3.5.4.2 Trigger Sensitivity. The Scope shall trigger on any signal that meets the following requirements. The amplitudes given below are i divisions. Required voltages are the number of divisions given times t volts/division setting of the input channel supplying the trigger. Th coupling below refers to the trigger coupling, not the vertical channel inp coupling.

3.5.4.2 Trigger Sensitivity Continued.

DC Coupled.	.35 divisions
AC coupled.	.35 divisions
HF Reject Coupled	.5 divisions
LF Reject Coupled	.5 divisions

3.5.4.3 Trigger Level Control. The trigger level shall be continuously variable.

3.5.5 Cursors. The Scope shall have two independent cursors for measuring voltage between two points on the screen ((V) and for measuring time betwe two points on the screen ((T). Either the (V or the (T cursors shall selected at any time.

3.5.5.1 (V Cursors. The (V cursors are used to measure voltage difference between two points.

3.5.5.1.1 Range. At least (3.8 divisions from the center graticule line.

3.5.5.1.2 Accuracy. Voltage between the two cursors shall have an uncertainty of no more than ((1.25% of reading + .03 divisions).

3.5.5.2 (T Cursors. The (T mode is used to measure elapsed time between two points.

3.5.5.2.1 Range. At least (4.8 divisions from the center graticule line.

3.5.5.2.2 Accuracy. The Scope shall measure time between two cursors with an uncertainty of at least ((.7% of time interval +.3 divisions). Th uncertainties are increased by .5% of the time interval if the 10 magnification is being used.

3.5.6 Z-axis Input. The Scope shall have an input connection that allows an external signal to vary the intensity of the trace.

3.5.7 Calibrator. The Scope shall have a calibrator output that produces a square wave useable to calibrate probes.

3.5.7.1 Voltage Output. 400mV (1% into a 1 Megohm load, 200mV (1.5% into a 50 ohm load.

3.5.7.1.1 Period. The calibrator shall have a period of two times the A sweep (.1%. The calibrator need not have a period of more than 200 ms or l than 200 ns.

3.6 Operating Requirements. The Scope shall provide the following operating capabilities.

3.6.1 Front Panel Control Requirements. All modes and functions shall be operable using front panel controls. The location and labeling of indicato controls, and switches shall provide for maximum clarity and easily underst operation without reference to tables, charts, or flow diagrams.

3.6.2 Self-Test. The self-test shall comprise two selectable levels, an operational test to determine if the instrument is operationally ready, and second level diagnostic test to diagnose and isolate faulty field replaceal modules. When the self-test function is initiated, an auto-sequenced inter operation test shall be performed. The diagnostic test shall be selectab only by deliberate operator command.

3.7 Manual. At least two copies of an operation and maintenance manual shal be provided. The manual shall meet the requirements of MIL-M-7298.

3.7.1 Calibration Procedure. The manual shall include a calibration procedure accordance with MIL-M-38793.

3.8 Accessories. The Scope shall include the following:

3.8.1 Cable. The Scope shall have one power cable with a 6-foot (1.8 m) minimum length.

3.8.2 Filters. The Scope shall have one clear snap-on CRT filter and one colored snap-on CRT filter to enhance the contrast of the display and redu glare.

3.8.3 Probes. Two probes shall be provided according to the following requirements.

3.8.3.1 Probe Attenuation. The probe shall have a nominal division ratio of 10 (3%.

3.8.3.2 Probe Input Loading. 10 Megohm in parallel with a maximum of 15 pF.

3.8.3.3 Probe Bandwidth. The probe bandwidth shall have a 3 dB point of at least 300 MHz.

3.8.3.4 Probe Cable Length. The probe shall have a cable length of at least 3 feet (.9 m).